

Name \_\_\_\_\_

## Appropriate Tools and Units

**Essential Question** What tools and units would you use to measure length, capacity, and weight or mass?

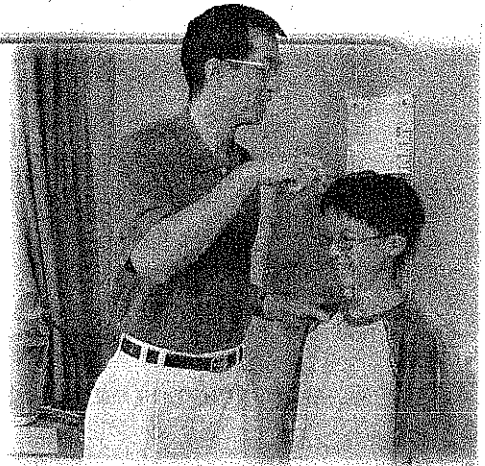
**M.12.5.1** Identify and select appropriate units and tools to measure

**M.13.5.2** Determine which unit of measure or measurement tool matches the context for a problem situation

### UNLOCK the Problem REAL WORLD

Mr. Lee wants to find Eric's height. What tool and unit should Mr. Lee use to measure Eric's height?

**?** Tell which units are measured by each tool.



#### Customary Length: Inch, Foot, Yard, and Mile

ruler

yardstick



trundle wheel



odometer

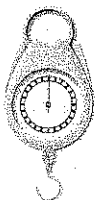
So, Mr. Lee would use a \_\_\_\_\_ to measure Eric's height and the unit he would use is \_\_\_\_\_.

Tell which units are measured by each tool.

#### Customary Capacity: Teaspoon, Tablespoon, Cup, Pint, Quart, and Gallon



#### Weight: Ounce and Pound



spring scale



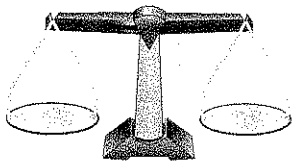
medical scale

#### Math Talk

Explain how a farmer might weigh a sheep for the fair.

**Metric Tools and Units** Mr. Wilkins takes his dog to the vet for a checkup. The vet first measures the dog's mass. What tool and unit do you think the vet uses to measure the dog's mass?

### Mass: Gram and Kilogram



pan balance



large scale

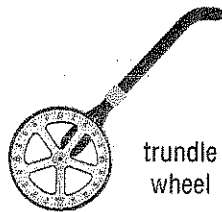
So, the vet uses a \_\_\_\_\_ to measure the dog's mass and the unit he would use is \_\_\_\_\_.

Tell which units are measured by each tool.

### Metric Length: Millimeter, Centimeter, Meter, Kilometer

metric ruler

meterstick



trundle wheel



odometer

### Metric Capacity: Milliliter and Liter



### Try This!

- What tool do you use to tell time?  
\_\_\_\_\_
- What unit of time would be used to measure the time it takes to walk to school?  
\_\_\_\_\_
- What tool would you use to find out when summer vacation begins?  
\_\_\_\_\_
- What unit of time is used to measure the growth of a plant? \_\_\_\_\_

Name \_\_\_\_\_

## Share and Show



Choose the appropriate metric tool and unit.

1. mass of a strawberry

\_\_\_\_\_

2. capacity of a medicine bottle

\_\_\_\_\_

3. length of a cell phone

\_\_\_\_\_

Metric	
Tools	Units
metric ruler	centimeter
medicine spoon	meter
measuring cup	kilometer
pan balance	gram
meterstick	kilogram
odometer	liter
trundle wheel	milliliter

### Math Talk

Explain why it is important to choose an appropriate tool and unit when measuring.

## On Your Own

Choose the appropriate customary tool and unit.

4. height of a vase

\_\_\_\_\_

5. capacity of a coffeepot

\_\_\_\_\_

6. distance traveled on vacation

\_\_\_\_\_

7. weight of a bag of tomatoes

\_\_\_\_\_

8. width of the seat of a chair

\_\_\_\_\_

9. distance run by a track team

\_\_\_\_\_

Customary	
Tools	Units
inch ruler	inch
measuring cup	foot
spring scale	mile
yardstick	ounce
odometer	pound
trundle wheel	cup
	gallon

## Problem Solving

REAL WORLD

10. Reasoning Would an inch ruler be a reasonable tool to use to measure the height of a water tower that is more than 68 feet tall? Explain.

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11. Which customary unit would most likely be used to measure the capacity of a water tower?

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12. Which metric unit would most likely be used to measure the distance between school and home?

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13. Robert wants to measure the mass of his peanut butter and jelly sandwich. Which tool and metric unit should Robert use?

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14. Pose a Problem Write a problem for which the tool is a measuring cup and the unit is the cup.

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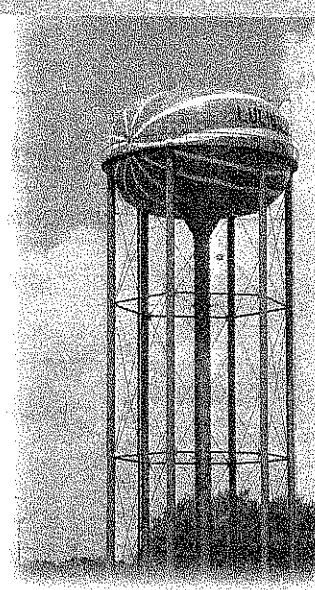
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15. ★ Test Prep Which tool would you use to measure the capacity of a coffee mug?

- (A) meterstick  
(B) spring scale  
(C) measuring cup  
(D) 1-liter container

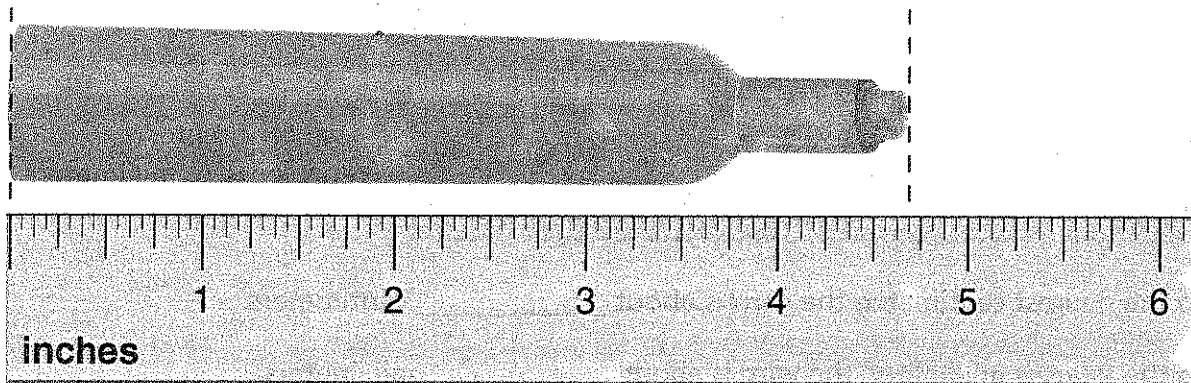


▲ The Luling, Texas, water tower was built and painted to look like a watermelon in honor of the town's annual Watermelon Thump festival

Name \_\_\_\_\_

**M.13.5.3** Draw and measure distance to the nearest cm and  $\frac{1}{4}$  inch accurately.**Measure Length****Essential Question** How can you measure lengths of objects to the nearest unit?**UNLOCK the Problem** REAL WORLD**Linear units** are used to measure length, width, height, and distance.

Which customary linear unit would you use to find the shortest box that a group of markers will fit into?

**Activity 1** Measure to the nearest  $\frac{1}{4}$  inch,  $\frac{1}{8}$  inch, and  $\frac{1}{16}$  inch.Measure the length of one marker to the nearest  $\frac{1}{4}$  inch,  $\frac{1}{8}$  inch, and  $\frac{1}{16}$  inch to decide on the shortest box.

Unit	What two lengths is the measurement between?	Length (to the nearest unit)	Would this box be long enough?
$\frac{1}{4}$ inch	$4\frac{2}{4}$ in. and $4\frac{3}{4}$ in.		
$\frac{1}{8}$ inch	_____ and _____		
$\frac{1}{16}$ inch	_____ and _____		

**Math Talk**






Explain how benchmarks help you select a unit of measure.

So, the shortest box that the markers will fit into must be

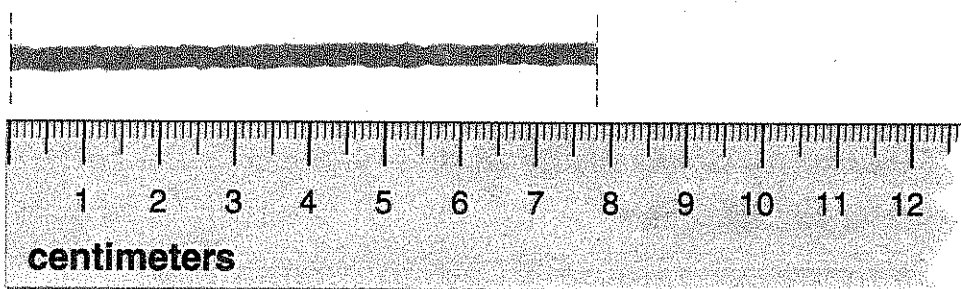
\_\_\_\_\_ inches tall.

- What if you estimated the length of the marker using a benchmark for  $\frac{1}{2}$  inch? What benchmark would you use? About how long is the measure?

**Metric Length** You can measure length, width, height, or distance using metric units. Some metric linear units are shown below. Shorter lengths, such as the yarn in Activity 1, are measured in centimeters or millimeters.

Metric Units of Length				
				
about 1 millimeter	about 1 centimeter	about 1 decimeter	about 1 meter	1 kilometer in about 10 minutes

## Activity 1 Measure the yarn to the nearest centimeter and millimeter.



Each centimeter represents 10 millimeters.

Measured to the nearest centimeter, the yarn is about \_\_\_\_\_ centimeters.

Measured to the nearest millimeter, the yarn is about \_\_\_\_\_ millimeters.

## Activity 2 Estimate and measure.

**Materials** ■ 2 classroom objects ■ metric ruler ■ meterstick

Estimate and measure the width of a student desk and the length, width, or height of two other classroom objects, using the appropriate linear unit. Complete the table.

**Math Talk** Explain how you can use your estimate to determine if your measurement is reasonable.

Lengths of Classroom Objects			
Object	Appropriate Unit	Estimate	Actual Measure
Student desk			

- Which metric unit would you use to measure the width of a student desk? \_\_\_\_\_

Name \_\_\_\_\_

## Share and Show

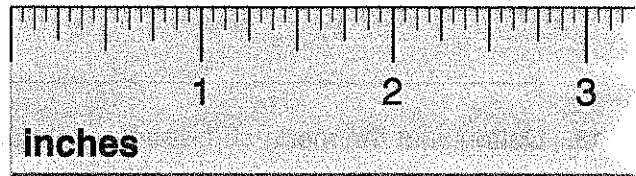


For 1–3, measure the length of the crayon to the nearest unit.

1. nearest  $\frac{1}{4}$  inch \_\_\_\_\_

2. nearest  $\frac{1}{8}$  inch \_\_\_\_\_

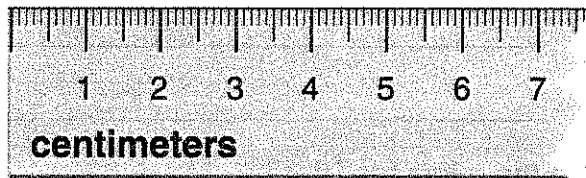
3. nearest  $\frac{1}{16}$  inch \_\_\_\_\_



For 4–5, measure the length of the ribbon to the nearest unit.

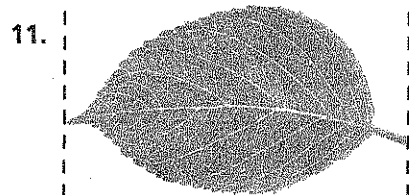
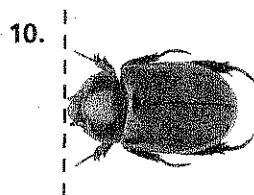
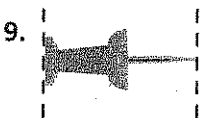
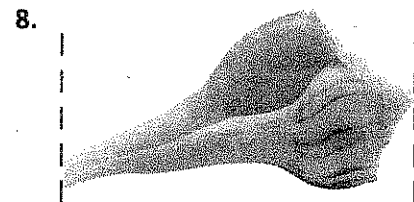
4. nearest centimeter \_\_\_\_\_

5. nearest millimeter \_\_\_\_\_



## On Your Own

Measure to the nearest  $\frac{1}{16}$  inch and to the nearest millimeter.



Use an inch ruler and a metric ruler. Draw a line for each length.  
Measure it to the nearest  $\frac{1}{16}$  inch or millimeter with the other ruler.

12. 58 millimeters

Customary length \_\_\_\_\_

13.  $4\frac{3}{4}$  inches

Metric length \_\_\_\_\_

# Problem Solving

REAL WORLD

Use the graph to solve 14–15.

14. About how many centimeters long is the ladybug? Which benchmark is this close to?

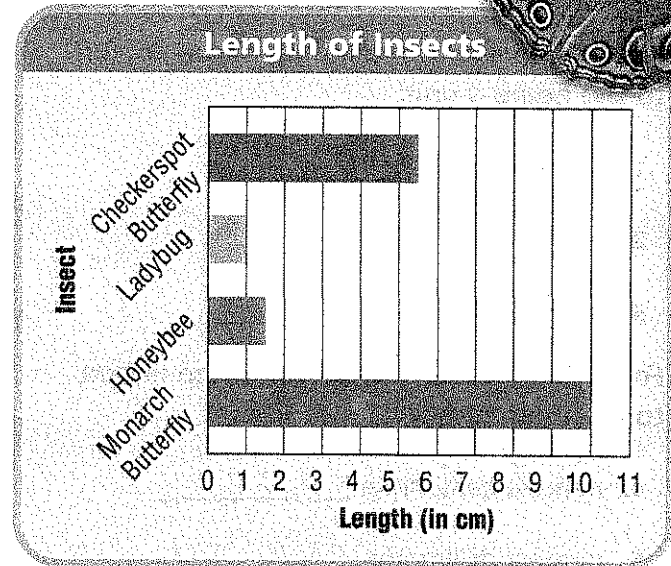
\_\_\_\_\_

15. Dalton said the monarch butterfly is about the same length as 10 ladybugs. Is he correct? Explain.

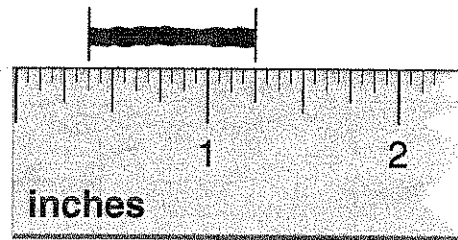
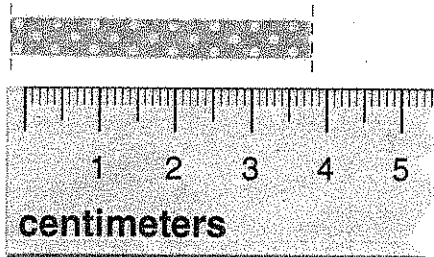
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



Use the rulers for 16–17.



16. **HOT** What's the Error? Emma measured the ribbon above. She said it was 38 millimeters long. Is Emma correct? Explain.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

17. **HOT** Tyler did not align the yarn correctly on the ruler. Explain how to find the length of the yarn using subtraction.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

18. **★ Test Prep** What is the length of the yarn in exercise 17 to the nearest  $\frac{1}{16}$  inch?

- (A)  $\frac{7}{16}$  inch  
 (B)  $\frac{12}{16}$  inch  
 (C)  $\frac{14}{16}$  inch  
 (D)  $1\frac{1}{16}$  inches



Name \_\_\_\_\_

## Estimate and Measure Angles

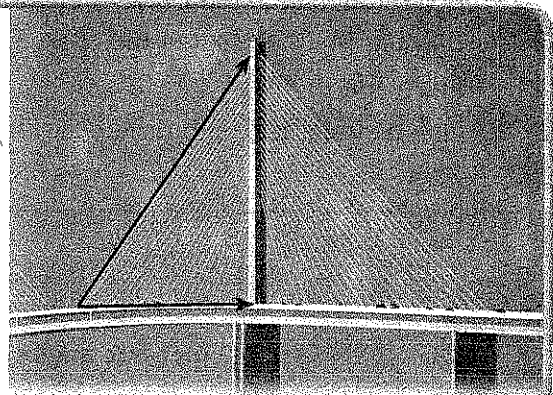
**Essential Question** How can you estimate and verify measurements of angles?

**M.12.5.1** Identify and select appropriate units and tools to measure

**M.13.5.6** Use benchmark angles to estimate the measure of angles

### UNLOCK the Problem REAL WORLD

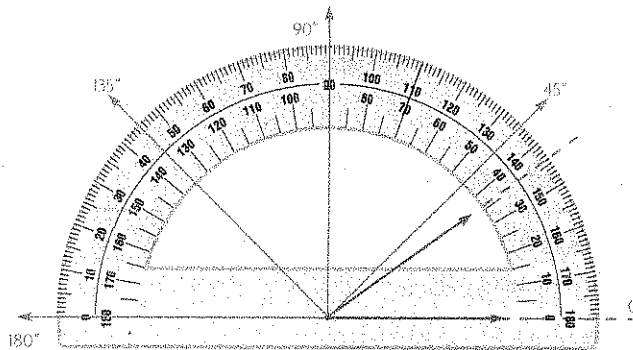
Margie wants to make a model of the Sunshine Skyway Bridge across Tampa Bay using the photo at the right. What tool can she use to measure the drawn angle in the photo?



#### Estimate and measure angles.

Angles are measured in **degrees (°)**. A **protractor** is a tool for measuring the size of an angle. Remember that common benchmark angles start at  $0^\circ$  and increase by  $45^\circ$ .

Benchmark angles include  $0^\circ$ ,  $45^\circ$ ,  $90^\circ$ , \_\_\_\_\_, and  $180^\circ$ .



**STEP 1** Estimate by comparing the angle measure to benchmark angles.

- Is the angle measure greater than or less than  $90^\circ$ ?

\_\_\_\_\_

- Which benchmark is closest to the measure of the given angle?

\_\_\_\_\_

- What is a good estimate of the measure of the angle?

\_\_\_\_\_

**STEP 2** Place the center point of the protractor on the vertex of the angle. Line up the bottom ray with the base of the protractor.

**STEP 3** Read the scale that starts with  $0^\circ$ .

- What is the measure of the angle?

\_\_\_\_\_

- How did your measurement compare with your estimate?

\_\_\_\_\_

\_\_\_\_\_

#### Math Talk

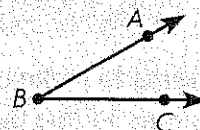
Can you place the bottom edge of the protractor on either ray of the angle when measuring? Explain.

**Try This!** Draw  $\angle DEF$  with a measure of  $62^\circ$ .

- Use a straightedge to draw ray  $EF$ . Label points  $E$  and  $F$ .
- Line up ray  $EF$  with the edge of the protractor. Place the center hole at point  $E$ . Mark a point at  $62^\circ$ . Label the point  $D$ .
- Use a straightedge to draw ray  $ED$ .

### Remember

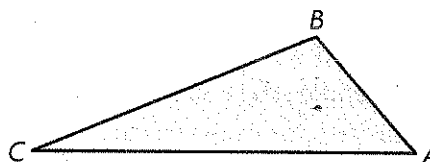
You can write an angle in different ways.



Write:  $\angle ABC$ ,  $\angle CBA$ , or  $\angle B$

### Example Measure angles in a plane figure.

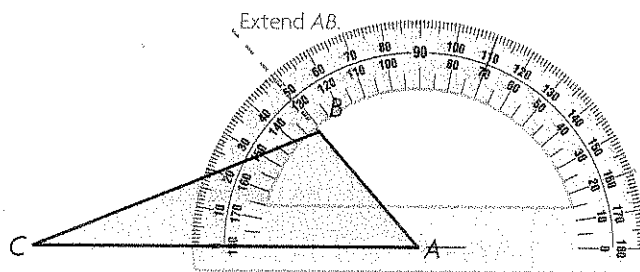
What are the measures of  $\angle A$  and  $\angle C$  in triangle  $ABC$ ?



**STEP 1** Use benchmarks to estimate the measure of  $\angle A$ .

- Which benchmark angle is the measure of  $\angle A$  closest to? \_\_\_\_\_
- Estimate the measure of  $\angle A$ . \_\_\_\_\_

**STEP 2** Place the protractor so that its center point is on the vertex of  $\angle A$ . Extend side  $AB$ . Measure  $\angle A$ .



- What is the measure of  $\angle A$ ? \_\_\_\_\_

**STEP 3** Repeat steps 1 and 2 for  $\angle C$ . Use the protractor scale with  $0^\circ$  on the right.

- Estimate the measure of  $\angle C$ . \_\_\_\_\_
- What is the measure of  $\angle C$ ? \_\_\_\_\_

### Math Talk

Explain why a protractor has two scales—one with  $0^\circ$  on the right and one with  $0^\circ$  on the left.

Name \_\_\_\_\_

## Share and Show



Estimate the measure of each angle. Then use a protractor to find the measure.

1.  $\angle TXW$

Estimate: \_\_\_\_\_

Measure: \_\_\_\_\_

2.  $\angle WXY$

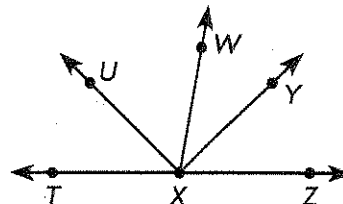
Estimate: \_\_\_\_\_

Measure: \_\_\_\_\_

3.  $\angle UXY$

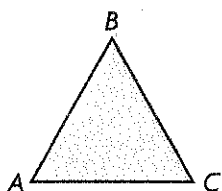
Estimate: \_\_\_\_\_

Measure: \_\_\_\_\_



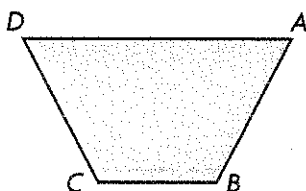
Find the measure of  $\angle A$  in each figure.

4.



\_\_\_\_\_

5.



\_\_\_\_\_

### Math Talk

Explain how estimating the measure of an angle helps you verify whether your measurement is reasonable.

## On Your Own

Estimate the measure of each angle. Then use a protractor to find the measure.

6.  $\angle YXZ$

Estimate: \_\_\_\_\_

Measure: \_\_\_\_\_

7.  $\angle VXT$

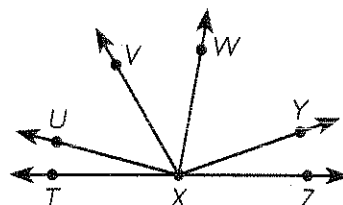
Estimate: \_\_\_\_\_

Measure: \_\_\_\_\_

8.  $\angle WXZ$

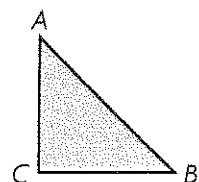
Estimate: \_\_\_\_\_

Measure: \_\_\_\_\_



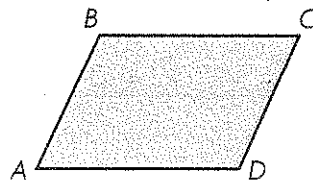
Find the measure of  $\angle A$  in each figure.

9.



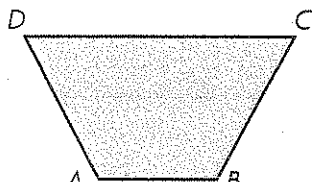
\_\_\_\_\_

10.



\_\_\_\_\_

11.



\_\_\_\_\_

Use a protractor to draw each angle.

12.  $35^\circ$

13.  $123^\circ$

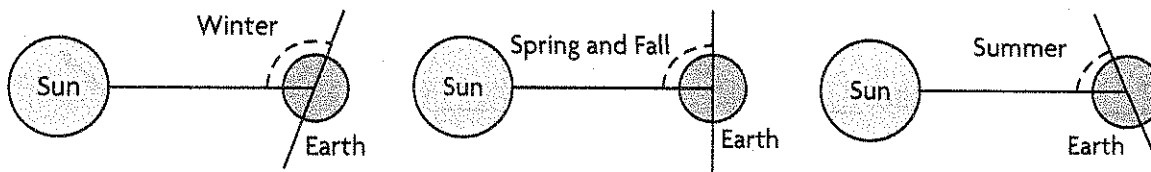
14. an acute angle

# Problem Solving



For 15–17, use the diagrams and a protractor.

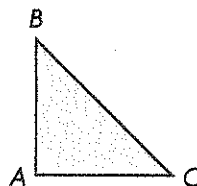
## Northern Hemisphere



15. In the Northern Hemisphere, Earth's axis is tilted away from the sun on the first day of winter, which is often on December 21. What is the measure of the marked angle on the first day of winter, the shortest day of the year?  
  
\_\_\_\_\_
16. Earth's axis is not tilted away from or toward the sun on the first days of spring and fall, which are often on March 20 and September 22. What is the measure of the marked angle on the first day of spring or fall?  
  
\_\_\_\_\_
17. In the Northern Hemisphere, Earth's axis is tilted toward the sun on the first day of summer, which is often on June 21. What is the measure of the marked angle on the first day of summer, the longest day of the year?  
  
\_\_\_\_\_
18. What's the Error? Tracy measured an angle as  $50^\circ$  that was actually  $130^\circ$ . Describe her error.  
  
\_\_\_\_\_  
  
\_\_\_\_\_

19. ★ Test Prep What is the measure of  $\angle B$  in triangle  $ABC$ ?

- (A)  $40^\circ$
- (B)  $45^\circ$
- (C)  $140^\circ$
- (D)  $135^\circ$



Name \_\_\_\_\_

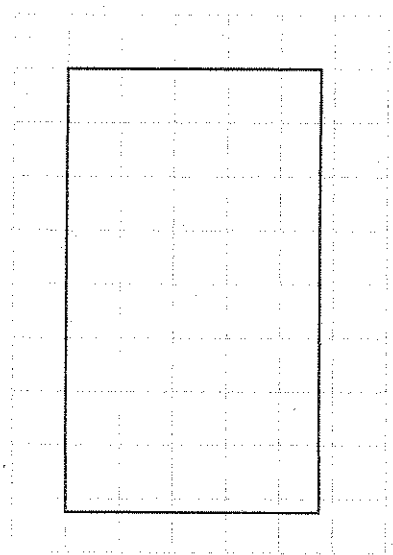
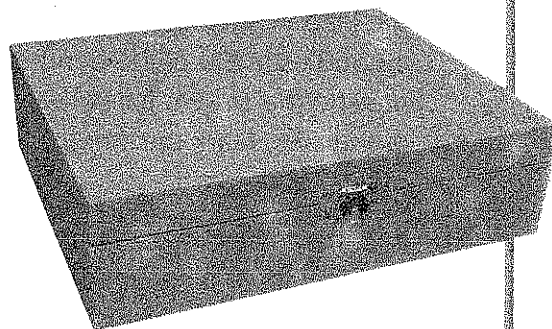
**Estimate Perimeter****Essential Question** How can you estimate perimeter?

**M.12.5.4** Understand when to use linear units to describe *perimeter*, square units to describe *area* or *surface area*, and cubic units to describe *volume*, in real world situations

**M.13.5.4** Develop and use *strategies* to solve real world problems involving *perimeter* and *area* of rectangles

**UNLOCK the Problem** REAL WORLD

Bridgette wants to put a row of gold trim around a jewelry box. About how much trim does she need? The tracing of the base of the jewelry box is shown on the grid below. Each square on the grid has a side length of  $\frac{1}{2}$  inch.

**STEP 1** Estimate the length of each side.

- What is the length of the box to the nearest  $\frac{1}{2}$  inch? \_\_\_\_\_
- What is the width of the box to the nearest  $\frac{1}{2}$  inch? \_\_\_\_\_

**STEP 2** Add the estimated lengths for the four sides.

$$\frac{\text{length}}{\text{length}} + \frac{\text{length}}{\text{length}} + \frac{\text{width}}{\text{width}} + \frac{\text{width}}{\text{width}} = \underline{\hspace{2cm}}$$

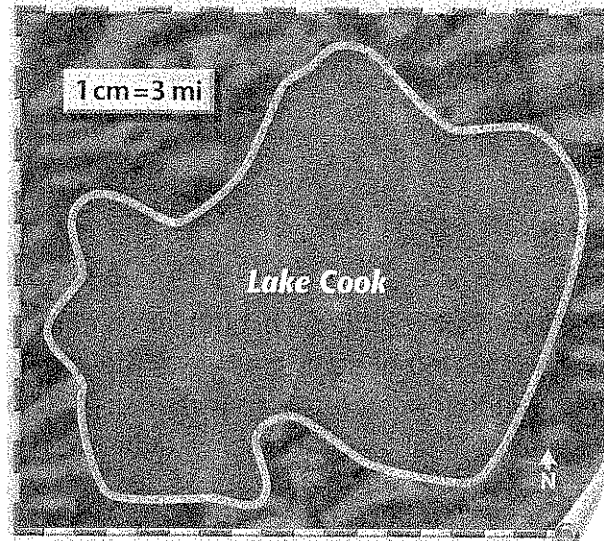
So, Bridgette needs about \_\_\_\_\_ inches of gold trim.

- Did you need to estimate the length of each side to find the perimeter? Explain. \_\_\_\_\_

## Activity

**Materials** ■ metric ruler ■ string

The bike club is planning to raise money for a bike path around Lake Cook. They need to estimate the perimeter of the lake.



- A.** On the map, lay a piece of string around the lake. Align the string carefully to get a good estimate of the perimeter. You may not be able to follow every contour of the lake. Mark the string where it meets itself.
- B.** In centimeters, measure the string up to the mark that you made.
- What is the length of the string to the nearest centimeter?
- \_\_\_\_\_
- C.** Look at the scale of the map.
- 1 cm = \_\_\_\_\_ mi
  - If the string was 1 cm long, how many miles would it represent? \_\_\_\_\_
  - If the string was 2 cm long, how many miles would it represent? \_\_\_\_\_
  - Write a rule you can use to find the distance in miles for any length of string. \_\_\_\_\_
- \_\_\_\_\_

- D.** How many miles does your string represent?

$$3 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

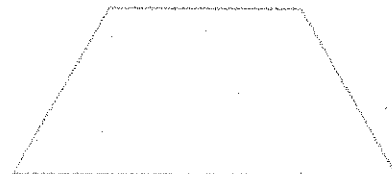
So, the perimeter of the lake is about \_\_\_\_\_ miles.

**Math Talk** What does it mean to estimate a measurement?

### Try This!

Use a benchmark to estimate the length of each side in inches. Then estimate the perimeter.

My benchmark: \_\_\_\_\_



So, the perimeter is about \_\_\_\_\_ inches.

Name \_\_\_\_\_

## Share and Show

1. Choose a small object in your classroom. Trace the base of the object on  $\frac{1}{2}$ -inch square grid paper. Estimate the perimeter.

object: \_\_\_\_\_ estimate: \_\_\_\_\_

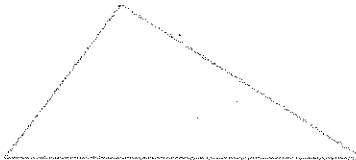
Use a benchmark to estimate the length of each side in inches. Then estimate the perimeter.

2.



about \_\_\_\_\_ inches

3.



about \_\_\_\_\_ inches

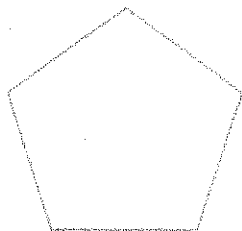
4. Use string to estimate the distance around the bottom of your shoe. Then use a ruler to measure the length of the string you marked to the nearest centimeter.

**Math Talk** Describe how estimating length is similar to estimating perimeter?

## On Your Own

Use a benchmark to estimate the length of each side in inches. Then estimate the perimeter.

5.



6.

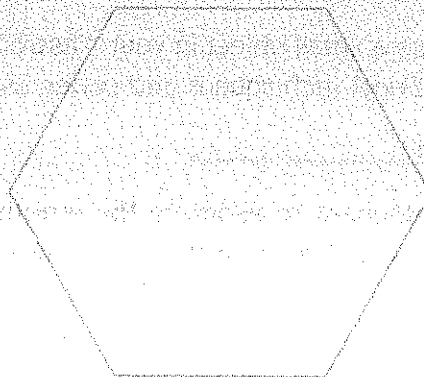


7.



8. For Exercises 5–7, what benchmark did you use to estimate 1 inch? Explain.

9. Carlie traced around the hexagon at the right on a sheet of paper. She wants to glue trim around the perimeter of the hexagon to make a frame. Which of the following is closest to the perimeter of the hexagon?



- (A) 6 centimeters    (C) 18 centimeters  
(B) 12 centimeters    (D) 24 centimeters

- a. What do you need to find?

\_\_\_\_\_

- b. What benchmark can you use to estimate the lengths of the hexagon?

\_\_\_\_\_

- c. What should you do next after estimating the length of each side?

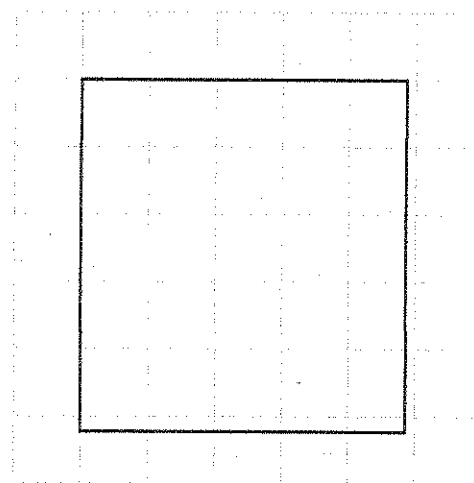
\_\_\_\_\_

- d. Fill in the bubble for the correct answer choice above.

10. **Write Math** Carlie has a regular hexagon. What property of regular polygons can she use to estimate the perimeter?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

11. The rectangle below is drawn on half-inch grid paper. Which estimate is closest to the perimeter of the rectangle?



- (A) 5 inches    (C) 15 inches  
(B) 10 inches    (D) 18 inches

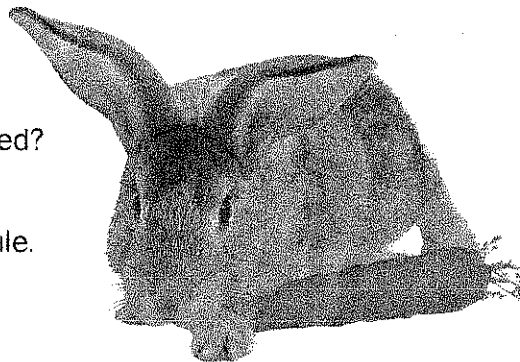


Name \_\_\_\_\_

**Perimeter Formulas****Essential Question** How can you use a formula to find the perimeter of a polygon?**M.13.5.4** Develop and use *strategies* to solve real world problems involving *perimeter* and *area* of rectangles**UNLOCK the Problem** REAL WORLD

Lloyd is planning a rectangular-shaped garden that is 40 feet by 24 feet. He wants to put a fence around it to protect his vegetables from rabbits. How many feet of fencing does he need?

You can use a formula to find the perimeter of a polygon. A **formula** is a set of symbols that expresses a mathematical rule.

**One Way** Use a formula.

$$P = l + w + l + w \quad P = \text{perimeter}; l = \text{length}; w = \text{width}$$

$$P = 40 + \underline{\quad} + \underline{\quad} + \underline{\quad} \quad \text{Replace the variables with the lengths and widths.}$$

$$P = \underline{\quad} \quad \text{Add.}$$

The perimeter is        feet.

**Another Way** Write and use a different formula.

**STEP 1** Use the Commutative Property of Addition to rearrange like variables so they are in the equation together.

$$P = l + l + w + w$$

**STEP 2** Use the Associative property to group the like variables.

$$P = (l + \underline{\quad}) + (w + \underline{\quad})$$

**STEP 3** Repeated addition and multiplication are the same. Rewrite the formula for the perimeter of a rectangle as the sum of two products.

$$P = \underline{\quad} l + \underline{\quad} w$$

**STEP 4** Find the perimeter using this formula.

$$P = 2l + 2w$$

$$P = 2 \times \underline{\quad} + 2 \times \underline{\quad}$$

$$P = \underline{\quad}$$

So, Lloyd will need        feet of fencing.

**Remember**

A rectangle has two pairs of parallel sides. The opposite sides of a rectangle are equal in length.

You can use addition or multiplication to find the perimeter of a regular polygon.

**Example 1** Use addition.

Find the perimeter of an equilateral triangle.

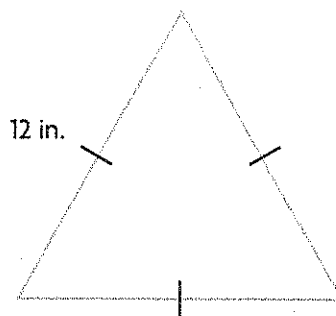
$$\text{Perimeter} = \text{side 1} + \text{side 2} + \text{side 3}$$

**Think:** Since a regular polygon has sides that are all the same length, use the variable  $s$  for the length of each side.

$$P = s + s + s$$

$$P = \underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}} \quad \text{Replace the variables with the lengths.}$$

$$P = \underline{\hspace{1cm}} \quad \text{Add.}$$



So, the perimeter of the equilateral triangle is            inches.

**Example 2** Use multiplication.

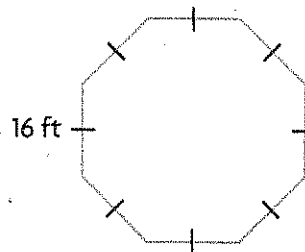
Find the perimeter of the regular octagon.

**Think:** Since a regular polygon has sides that are all the same length, I can multiply the number of sides by the length of each side to find the perimeter.

$$P = 8 \times s$$

$$P = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \quad \text{Replace the variable with the length.}$$

$$P = \underline{\hspace{1cm}} \quad \text{Multiply.}$$



So, the perimeter of the octagon is            feet.

- Suppose you have a regular pentagon with the length of one side labeled 12 inches. Explain how you would find the perimeter of the pentagon.

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Name \_\_\_\_\_

# Share and Show

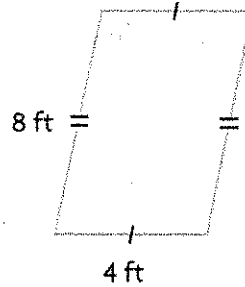
1. Find the perimeter of the parallelogram.

Perimeter = \_\_\_\_\_  $\times$  \_\_\_\_\_ + \_\_\_\_\_  $\times$  \_\_\_\_\_

$P =$  \_\_\_\_\_  $\times$  \_\_\_\_\_ + \_\_\_\_\_  $\times$  \_\_\_\_\_

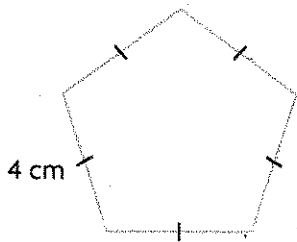
$P =$  \_\_\_\_\_ + \_\_\_\_\_

$P =$  \_\_\_\_\_ The perimeter is \_\_\_\_\_ feet.

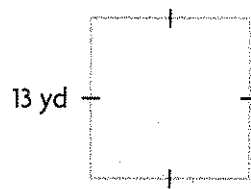


Find the perimeter.

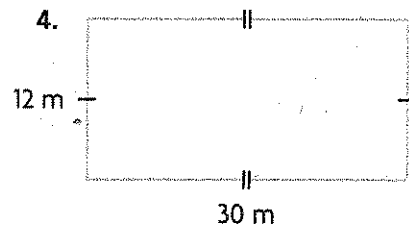
2.



3.



4.



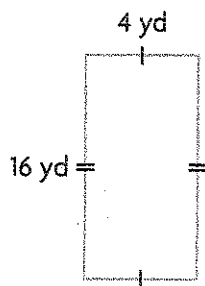
## Math Talk

Explain what formula you would use to find the perimeter of a square.

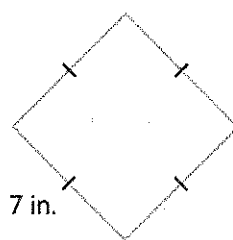
# On Your Own

Find the perimeter.

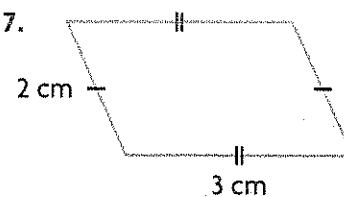
5.



6.



7.



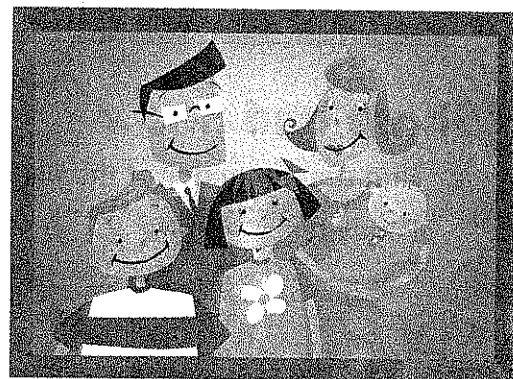
8. Find the perimeter of a rhombus that has a side that is 23 inches long.

9. Find the perimeter of a regular octagon that has a side that is 9 centimeters long.

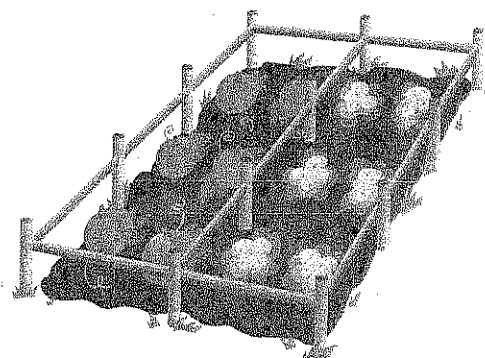
# Problem Solving

REAL WORLD

10. Alfonse is building a frame for a family portrait. The picture is in the shape of a rectangle. It is 11 inches long and 8 inches wide. How much wood does he need?



11. What's the Error? Maggie wants to fence off two side-by-side sections of her garden. Each section is 14 feet long and 6 feet wide. She says she needs 80 feet of fencing. Explain what is wrong with her thinking. How much fencing does she really need?



12. **HOT** Tyrone is gluing 1-inch square tiles around the sides of a rectangular table he is making. He needs 72 tiles. If one side is 12 inches, how long is the other side?

SHOW YOUR WORK

13. Isaac wants to put a chair rail around his dining room. The room is rectangular and measures 15 feet long and 10 feet wide. How many feet of railing does he need?

14. Lilly has 38 inches of decorative chord to put around the edge of a square pillow. If Lilly's pillow is 10 inches on each side, does she have enough decorative chord? Explain.

15. ★ **Test Prep** Meredith is decorating a scrapbook by gluing ribbon around the edge of the cover. Her book is 10 inches by 12 inches. How much ribbon does she need?

- (A) 22 inches      (C) 44 inches  
(B) 34 inches      (D) 120 inches

Name \_\_\_\_\_

## Estimate Area

**Essential Question** How can you estimate the area of plane figures?

AR.5.4

**M.12.5.4** Understand when to use linear units to describe *perimeter*, square units to describe *area* or *surface area*, and cubic units to describe *volume*, in real world situations

**M.13.5.4** Develop and use *strategies* to solve real world problems involving *perimeter* and *area* of rectangles

### UNLOCK the Problem REAL WORLD

The **area** of a figure is the number of square units needed to cover its surface. A **square unit** is a square that is 1 unit long by 1 unit wide.

Joseph and Bonnie are putting together a jigsaw puzzle. How can they estimate the area of one puzzle piece?

### Activity

**Materials** ■ centimeter grid paper ■ color pencils

**A.** Use the diagram at the right. Shade the full squares in one color.

There are \_\_\_\_\_ full squares.

**B.** Shade the squares that are more than half full with a different color.

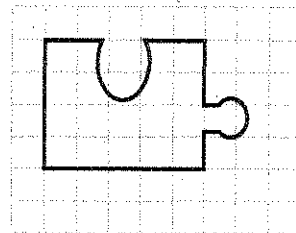
There are \_\_\_\_\_ squares that are more than half full.

**C.** Find the sum of the numbers of full and more than half full squares.

Think: When estimating with fractions, fractions greater than  $\frac{1}{2}$  were rounded up to a whole. I can count the squares that are more than  $\frac{1}{2}$  as about 1 square centimeter.

\_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_

So, the area of the puzzle piece is about \_\_\_\_\_ square centimeters.



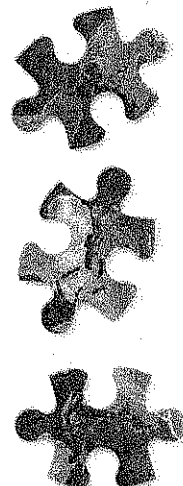
• How could you find an estimate that is closer to the actual area?

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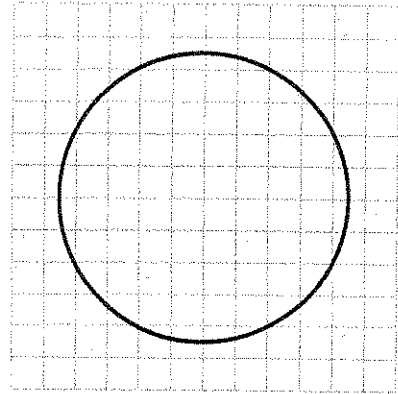
## Example

Joel and Natalie completed a circular puzzle. They traced it on a grid so they could estimate its area. Each square on the grid is 1 square inch.

- Count the whole squares. \_\_\_\_\_
- Count the squares that are about half full. \_\_\_\_\_
- How many whole squares can be made from the squares that are about half full? \_\_\_\_\_
- Combine any squares that are less than half full to make full squares. How many whole squares can you make?  
\_\_\_\_\_
- Find the sum of the counted squares and the number of squares that are the result of combining partial squares.

$$\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

So, the area of the puzzle is about \_\_\_\_\_ square inches.



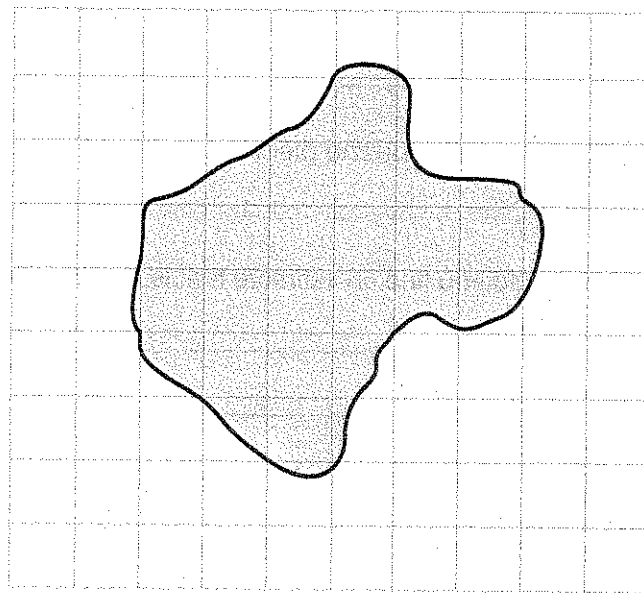
## Try This!

Terrance wants to find the area of a lake near his house. He found a map of the lake that is marked with grid squares. Each square represents 1 square mile.

Use the map to estimate the area of the lake.

- There are \_\_\_\_\_ whole squares.
- Partial squares can be combined to form about \_\_\_\_\_ whole squares.

So, the lake on the map covers about \_\_\_\_\_ squares or square miles.



1 square = 1 square mile

Name \_\_\_\_\_

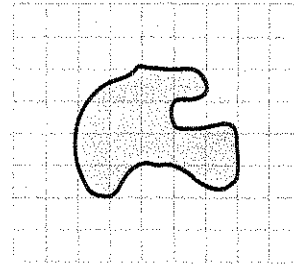
## Share and Show

1. There are \_\_\_\_\_ whole squares.

There are \_\_\_\_\_ groups of partial squares that combine to make whole squares.

\_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_

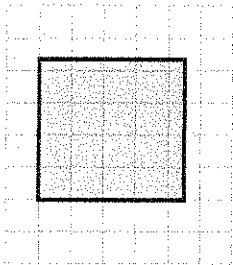
The area is about \_\_\_\_\_ square feet.



1 square = 1 square foot

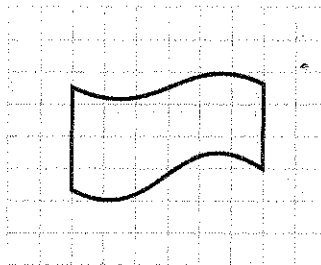
Estimate the area of the shaded figure. Each square is equal to 1 square foot.

2.



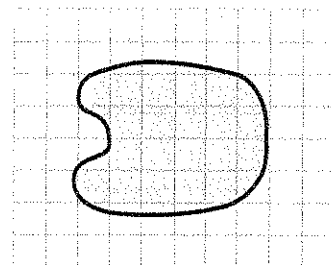
\_\_\_\_\_

3.



\_\_\_\_\_

4.

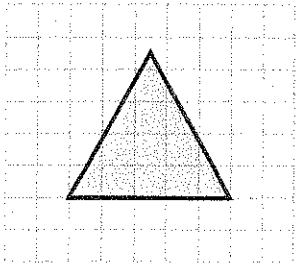


\_\_\_\_\_

## On Your Own

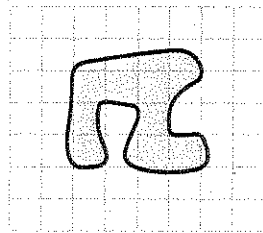
Estimate the area of the shaded figure. Each square is equal to 1 square meter

5.



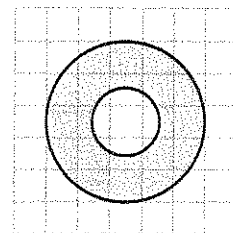
\_\_\_\_\_

6.



\_\_\_\_\_

7.



\_\_\_\_\_

8. **Write Math** Explain how you could estimate the area of the center of the doughnut shape in Exercise 7.

\_\_\_\_\_

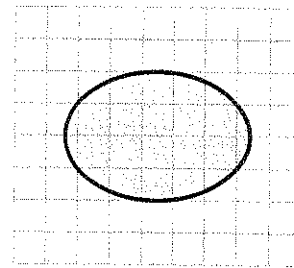
\_\_\_\_\_

# Problem Solving



For Exercises 9–10, use the following information.

Marta planted a flower garden. She used the plan shown at the right. She needs to apply fertilizer to help the plants bloom. The bag of fertilizer says to use 10 pounds to cover 100 square feet.



1 square = 1 square foot

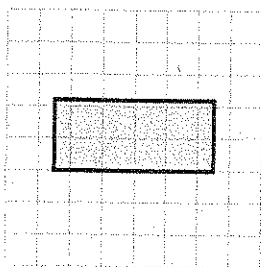
9. About how many square feet is Marta's garden?

\_\_\_\_\_

10. **HOT** How many pounds of fertilizer will Marta need to fertilize her garden once? Explain.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

11. **★ Test Prep** Which of the following is the best estimate for the area of the figure?



1 square = 1 square meter

- (A) about 8 square meters
- (B) about 9 square meters
- (C) about 10 square meters
- (D) about 14 meters

SHOW YOUR WORK



Name \_\_\_\_\_

**Find Area****Essential Question** How can you find the area of a square and a rectangle using a formula?**M.13.5.4** Develop and use *strategies* to solve real world problems involving *perimeter* and *area* of rectangles**UNLOCK the Problem** REAL WORLD

In art class, Mina is drawing plans for a rectangular flower garden. Mina's plans are for a garden that is 7 yards by 9 yards. What is the area of Mina's garden?

**One Way** Count square units.

Find the area by counting square units.

- Each square on the grid represents 1 square yard. Use the rectangle at the right that is 7 squares by 9 squares.
- Count the total number of squares. Record your answer in square yards.

Area = \_\_\_\_\_ square yards

**Another Way** Use a formula.

Find the area by using a formula.

- Look at the figure. The *base*,  $b$ , of the rectangle equals the number of squares in each row. Count the number of squares.

 $b =$  \_\_\_\_\_

- The *height*,  $h$ , of the rectangle equals the number of rows. Count the number of rows.

 $h =$  \_\_\_\_\_

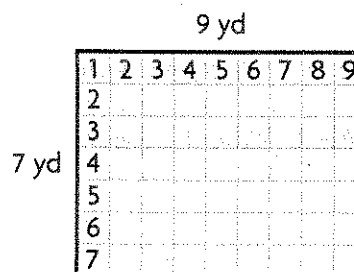
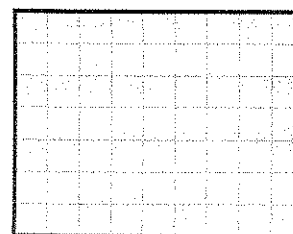
- What multiplication sentence does the shaded array represent?

\_\_\_\_\_

- Look at your multiplication sentence. What formula can you write to find the area of the rectangle? \_\_\_\_\_

- The area of the rectangle is \_\_\_\_\_  $\times$  \_\_\_\_\_, or \_\_\_\_\_.

So, the area of Mina's garden is \_\_\_\_\_ square yards.





## Example 1

Find the area of a rectangle.

$A$  = Area,  $b$  = base,  $h$  = height

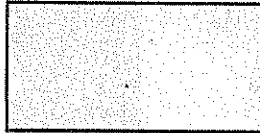
$$A = b \times h$$

$$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

$$A = \underline{\hspace{2cm}}$$

2 yd

4 yd



So, the area of the rectangle

is            square yards.



## Example 2

Find the area of a square.

$$A = b \times h$$

Think: A square is a special rectangle with four congruent sides. Since  $b = h$ , let  $s$  = the length of each side.

$$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \quad \text{Write a formula.}$$

$$A = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \quad \text{Find the area.}$$

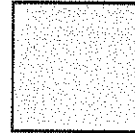
$$A = \underline{\hspace{2cm}}$$

So, the area of the square

is            square meters.

6 m

6 m



### Try This!

You can find the area of a complex polygon by dividing it into two or more simpler polygons.

**STEP 1** Divide the polygon into a rectangle and a square.

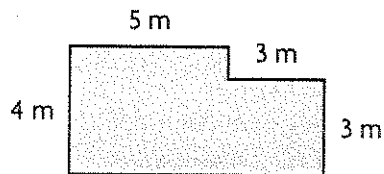
**STEP 2** Find the area of the rectangle.

$$A = b \times h$$

$$A = \underline{\hspace{2cm}}$$

$$A = \underline{\hspace{2cm}}$$

The area of the rectangle is            square meters.



**STEP 3** Find the area of the square.

$$A = \underline{\hspace{2cm}}$$

$$A = \underline{\hspace{2cm}}$$

$$A = \underline{\hspace{2cm}}$$

The area of the square is            square meters.

**STEP 4** Find the area of the polygon by adding the areas of the rectangle and the square.

$$A = \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$$

So, the area of the polygon is            square meters.

Name \_\_\_\_\_

# Share and Show



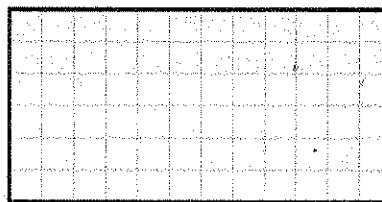
1. Find the area of the rectangle.

The rectangle has \_\_\_\_\_ rows of \_\_\_\_\_.

$$A = b \times h$$

$$A = \_\_\_\_\_\_ \times \_\_\_\_\_\_$$

$$A = \_\_\_\_\_\_$$

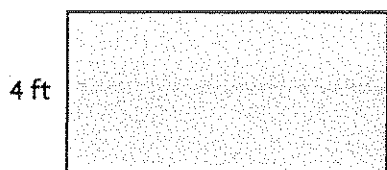


1 square = 1 square yard

So, the area of the rectangle is \_\_\_\_\_ square yards.

Find the area.

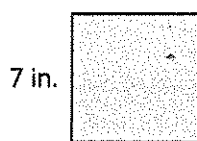
2. 8 ft



4 ft

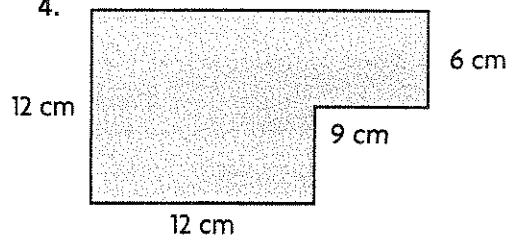
- 3

7 in.



7 in.

- 4.



12 cm

12 cm

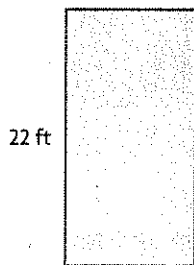
9 cm

6 cm

## On Your Own

Find the area.

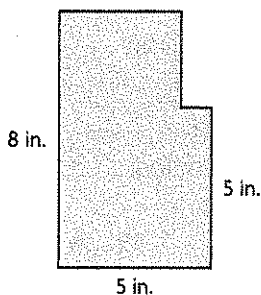
5. 10 ft



22 ft

- 6.

4 in.



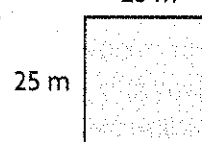
8 in.

5 in.

5 in.

- 7.

25 m



25 m

**Practice: Copy and Solve** Find the area of each square or rectangle.

8.  $b = 7$  m

$h = 2$  m

9.  $s = 13$  ft

10.  $b = 5$  cm

$h = 22$  cm

11.  $b = 61$  in.

$h = 33$  in.

12.  $b = 9$  in.

$h = 7$  in.

13.  $b = 11$  cm

$h = 5$  cm

14.  $s = 8$  m

15.  $b = 11$  ft

$h = 7$  ft

## Problem Solving

REAL WORLD

16. Brent plans to stain a deck that is 14 feet by 8 feet. If 1 can of stain covers an area of 100 square feet, how many cans of stain will he need? Explain.

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17. ★ Test Prep Paula wants to tile the floor of her kitchen. Each tile has an area of 1 square foot. The floor of her kitchen is 11 feet by 16 feet. How many tiles does she need?

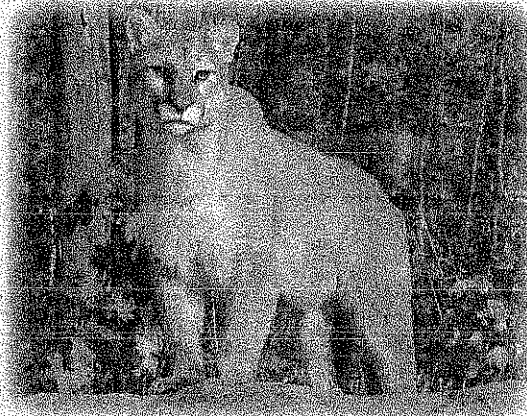
- (A) 54  
(B) 150  
(C) 176  
(D) 352

### Connect to Science

#### Mountain Lions

Mountain lions are also known as cougars, panthers, or pumas. Their ranges once were from coast to coast in North America and from Argentina to Alaska. Hunting and habitat destruction now restricts their range to mostly mountainous, unpopulated areas.

Mountain lions are solitary animals. A male's territory often overlaps two females' territories but never overlaps another male's. The average size of a male's territory is 108 square miles, but it may be smaller or larger depending on how plentiful food is. The average size of a female's territory is 54 square miles.



18. A male mountain lion has a rectangular territory that is 12 miles by 8 miles. What is the area of his territory?

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19. A male and female mountain lion have overlapped territories. The area of overlap is 28 square miles. Using the data above, how much of the male's and female's territory is not shared?

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Name \_\_\_\_\_

## Build Three-Dimensional Shapes

**Essential Question** How can you decide whether a pattern forms a three-dimensional shape or whether a three-dimensional shape can be cut apart to form a two-dimensional pattern?

**CONNECT** You can use what you know about identifying two-dimensional shapes to build three-dimensional shapes.

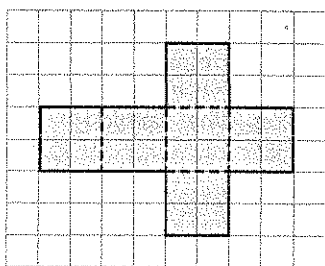
### UNLOCK the Problem REAL WORLD

A **net** is a two-dimensional pattern that can be folded to make a three-dimensional shape. What three-dimensional shape can be built from the pattern shown below?

### Activity 1 Build a three-dimensional shape.

**Materials** ■ net ■ scissors ■ tape

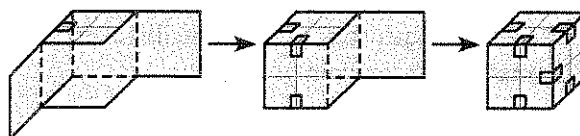
**STEP 1** Cut out the net along the solid lines.



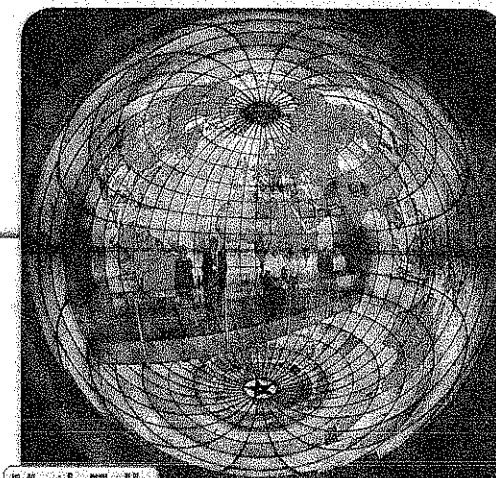
**STEP 2** Fold along the dashed lines.



**STEP 3** Tape the edges together. Be sure that there are no gaps and that none of the faces overlap.

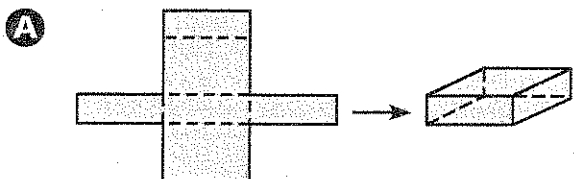


The net can be folded to make a cube.

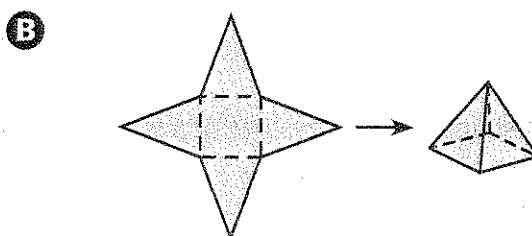


**Math Talk** Could you decompose a globe — like the Mapparium, in Boston, Massachusetts — into two-dimensional shapes? Why or why not? Explain.

**Try This!** Repeat the steps above. Count the number of faces. Identify the shape.



\_\_\_\_ faces \_\_\_\_\_



\_\_\_\_ faces \_\_\_\_\_



## Activity 2 Explore nets.

How many different nets can you make that can be folded into a three-dimensional shape such as a cereal box?

**Materials** ■ small empty box ■ grid paper ■ scissors ■ tape

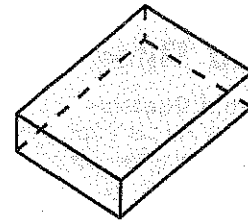
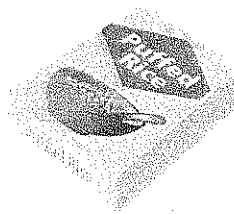
- Look at your small box from its front, top, and side views.
- How many faces do you see? \_\_\_\_\_

Name the shapes of the faces of the box. \_\_\_\_\_

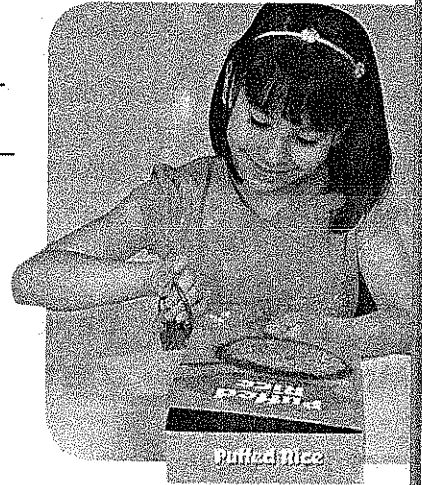
- What do you think a net of your box would look like?  
On grid paper, draw a net that you think would fold into a box similar to your box.\*
- Use your box to make a net. Cut along some of the edges until the box is flat. Be sure that each face is connected to another face by at least one edge.
- Compare the net you drew with the net of your box. How are they alike? How are they different? \_\_\_\_\_

- Test your net. Cut it out and fold it to see if it folds into a box. Tape the edges together, if possible. Did your net fold into a box? If not, explain your error.

- Name the two-dimensional shapes that make up the net.



rectangular prism



**Math Talk** Compare your classmates' nets that folded into boxes. What can you conclude?

## Share and Show



1. What shapes make up a net of a triangular pyramid? How many of them are there? \_\_\_\_\_

**Math Talk** Explain how the nets for a cube and a rectangular prism are alike and how they are different.

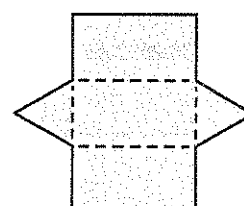
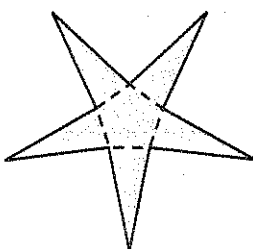
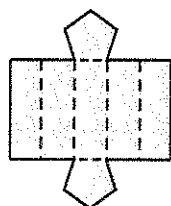
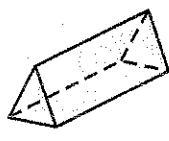
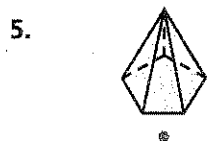
Name \_\_\_\_\_

Identify the three-dimensional shape that can be made from the net.

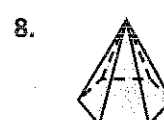
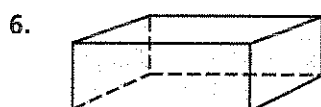


## On Your Own .....

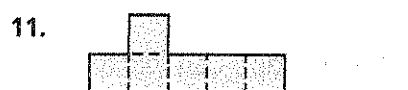
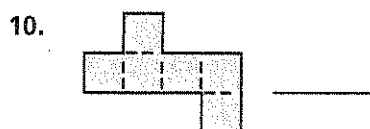
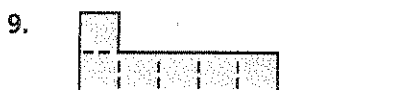
Draw a line to match the three-dimensional shape with the net.



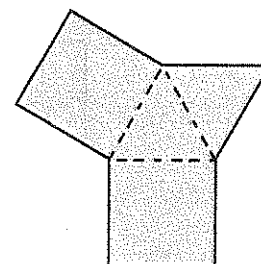
**Practice: Copy and Solve** On grid paper, draw a net that can be cut to make a model of the three-dimensional shape.



Could the net be folded to make a cube? Write *yes* or *no*.

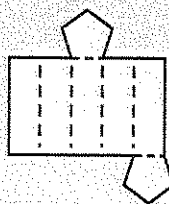


12. **NOT** What's the Error? Eric said that the net at the right can be folded to make a triangular prism. Describe Eric's mistake. Then, on grid paper, draw a net he could use to make a triangular prism.



# UNLOCK the Problem REAL WORLD

13. Caroline folded this net to make a three-dimensional object she will use as a gift box. What three-dimensional shape did she make?



- a. What do you need to find?

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- b. How will you use what you know about nets to help you solve the problem?

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- c. Tell how you might visualize the three-dimensional shape that can be made from the net.

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- d. Make a model to solve the problem.

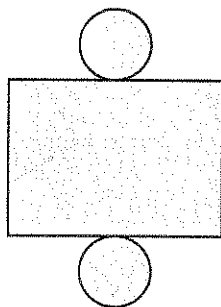
- e. Complete the sentences.

Caroline's net has \_\_\_\_\_ faces.

There are \_\_\_\_\_ pentagonal faces and \_\_\_\_\_ rectangular faces.

The three-dimensional object she made is a \_\_\_\_\_.

14. What shape can this three-dimensional pattern make?




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15. ★ Test Prep Juan has this three-dimensional object. Which two-dimensional shapes make up the net for this three-dimensional object?



- (A) hexagons      (C) rectangles  
(B) triangles      (D) circles



Name \_\_\_\_\_

## Explore Surface Area

**Essential Question** How do you tell when to use surface area and when to use volume?

**CONNECT** You can use what you know about area to find the surface area of a solid figure made from its net. **Surface area** is the total area of all of the faces of a solid figure.

**M.12.5.4** Understand when to use linear units to describe *perimeter*, square units to describe *area* or *surface area*, and cubic units to describe *volume*, in real world situations

**M.12.5.5** Model the differences between covering the *faces* (*surface area/nets*) and filling the *interior* (*volume of cubes*)

## Investigate

**Materials** ■ centimeter grid paper, centimeter unit cubes, scissors

**Find the surface area of a rectangular prism.**

- A.** Use centimeter grid paper to make a net like the one shown at the right. Label the net, cut it out, and fold it into a rectangular prism.
- B.** Find the area of each rectangular face that makes up the solid figure:

left: \_\_\_\_\_ right: \_\_\_\_\_

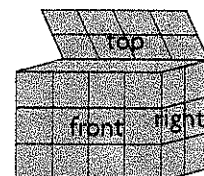
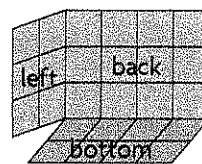
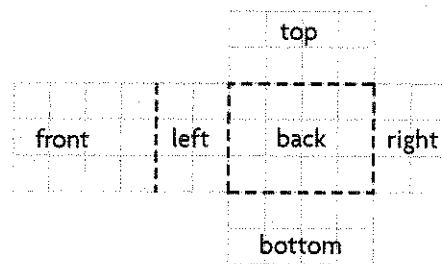
bottom: \_\_\_\_\_ top: \_\_\_\_\_

front: \_\_\_\_\_ back: \_\_\_\_\_

- C.** Use the areas of the faces to find the surface area of the rectangular prism:

\_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_

+ \_\_\_\_\_ = \_\_\_\_\_

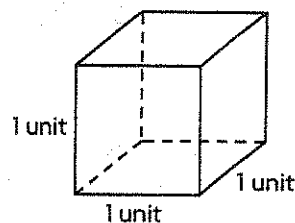


## Draw Conclusions .....

- Complete:** Area is measured in square units.  
Since surface area is the sum of areas, it is measured in \_\_\_\_\_.
- Identify** How are the faces of the rectangular prism that have the same area related?  
\_\_\_\_\_
- What formula can you write to find the surface area of a rectangular prism?  
\_\_\_\_\_

# Make Connections .....

A **unit cube** is a cube that has a length, width, and height of 1 unit. The number of unit cubes needed to fill an entire solid figure is known as its **volume**.



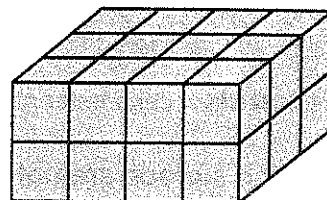
Find the volume of the rectangular prism from page 165 by filling it with centimeter cubes.

How can you find the number of cubes in the bottom layer without counting? \_\_\_\_\_

How can you find the number of cubes needed to fill the entire prism without counting? \_\_\_\_\_

Complete: A total of \_\_\_\_\_ centimeter cubes are needed to fill the prism, so the volume is \_\_\_\_\_  $\text{cm}^3$ .

What formula can you write to find the volume of a rectangular prism?



**Hint:** Use the number of layers.

The volume of this prism is measured in centimeter cubes, or cubic centimeters, which is abbreviated  $\text{cm}^3$ .

## Try This!

Find the surface area and volume of the rectangular prism.

Surface Area =  $2(\text{area of top}) + 2(\text{area of right}) + 2(\text{area of front})$

$$= 2(\text{ } \times \text{ }) + 2(\text{ } \times \text{ })$$

$$+ 2(\text{ } \times \text{ })$$

$$= 2(\text{ }) + 2(\text{ }) + 2(\text{ })$$

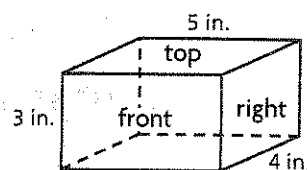
$$= \text{ } + \text{ } + \text{ }$$

$$= \text{ } \text{in.}^2$$

Volume = length  $\times$  width  $\times$  height

$$= \text{ } \times \text{ } \times \text{ }$$

$$= \text{ } \text{in.}^3$$



**Math Talk** Why are  $\text{in.}^3$  used to measure the volume of this prism?

Name \_\_\_\_\_

## Share and Show

Determine whether each scenario requires finding the surface area or the volume:

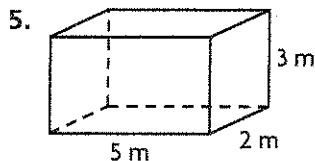
1. the amount of glass needed to build an aquarium  
\_\_\_\_\_

2. the amount of dirt needed to fill a wheelbarrow  
\_\_\_\_\_

3. the amount of air needed to fill a basketball  
\_\_\_\_\_

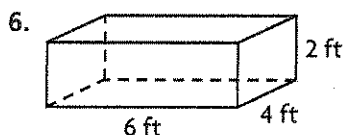
4. the amount of shrink wrap needed to cover a toy  
\_\_\_\_\_

Find the surface area and volume.



Surface Area = \_\_\_\_\_

Volume = \_\_\_\_\_



Surface Area = \_\_\_\_\_

Volume = \_\_\_\_\_

## On Your Own

Determine whether each scenario requires finding the surface area or the volume:

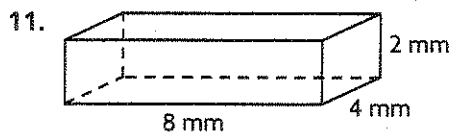
7. the amount of paper needed to cover a gift box  
\_\_\_\_\_

8. the amount of paint needed to cover a house  
\_\_\_\_\_

9. the amount of water needed to fill a jug  
\_\_\_\_\_

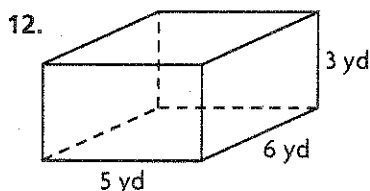
10. the amount of gasoline needed to fill a tank  
\_\_\_\_\_

Find the surface area and volume.



Surface Area = \_\_\_\_\_

Volume = \_\_\_\_\_



Surface Area = \_\_\_\_\_

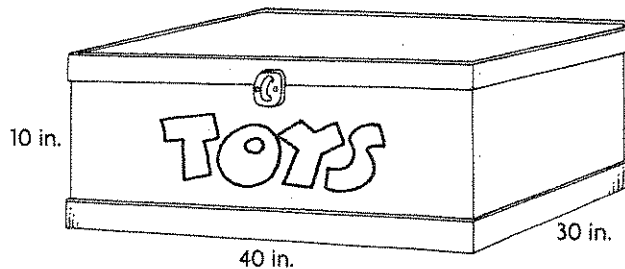
Volume = \_\_\_\_\_

## Problem Solving

REAL WORLD

Use the following information to answer 13–15.

Jada has a toybox with a snug-fitting top. The dimensions of the box are 40 in. by 30 in. by 10 in.



13. Jada wants to paint completely the outside of the toybox. What is the surface area that needs to be painted?

\_\_\_\_\_

14. How much space is in the toybox?

\_\_\_\_\_

15. What's the Error? Ramon used only the length and width of the toybox to find its volume. What did he do wrong?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

16. **HOT** Theodore realized that he could simplify the formulas for volume and area when his rectangular prism is a cube. What formulas could he have used? **Hint:** Use only one variable.

\_\_\_\_\_

17. ★ **Test Prep** What is the surface area of a cube with a side length of 9 m?

- (A)  $27 \text{ m}^2$   
(B)  $54 \text{ m}^2$   
(C)  $486 \text{ m}^2$   
(D)  $729 \text{ m}^2$

SHOW YOUR WORK